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Cambridge, Massachusetts
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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Sir:

This is an appeal from the final rejection of all claims of the above application as set forth in the Office Action mailed January 24, 2006.

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REAL PARTY IN INTEREST

The real party in interest in this appeal is E Ink Corporation, a corporation organized and existing under the laws of the State of Delaware, of 733 Concord Avenue, Cambridge, MA 02138-1002.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1, 5, 6, 8-21, 24, 25 and 27-49 are pending in this application, claims 2-4, 7, 22, 23 and 26 having been cancelled. All claims stand finally rejected; no claim is objected to. A copy of the pending claims appears in the Appendix to this Brief.

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STATUS OF AMENDMENTS

No Amendment After Final Rejection has been filed, so all Amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 of this application is directed to a dielectrophoretic display (100 in Figures 1-3; 900 in Figures 9-11) comprising a substrate having walls (the walls of the capsule 104 in Figures 1-3; walls 122 in Figures 9-11) defining at least one cavity, the cavity having a viewing surface (the upper surface as illustrated in Figures 1-3 and 9-11) and a side wall (122) inclined to the viewing surface; a suspending fluid (106) confined within the cavity; a plurality of a first type of particle (108) suspended within the suspending fluid (106) and having a first optical characteristic (black - see Paragraph 50) and a first electrophoretic mobility (positive - see Paragraph 50); a plurality of a second type of particle (110) suspended within the suspending fluid (106) and having a second optical characteristic (white - Paragraph 50) different from the first optical characteristic and a second electrophoretic mobility (negative - Paragraph 50) different from the first electrophoretic mobility; a backing member (116) disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member (116) having a third optical characteristic (the backing member 116 actually has discrete red, green and blue areas, as described in Paragraph 57 and shown in Figure 6) different from the first and second optical characteristics; and means (the electrodes 112 and 114 in Figure 1, and electrodes 112, 114 and 126 in Figure 9) for applying to the substrate an electric field effective to cause dielectrophoretic movement of the first (108) and second (110) types of particles to the side wall of the cavity (see Figures 3 and 11).

The present invention increases the number of colors which can be produced by a single pixel of a display. A conventional dual particle electrophoretic display comprising two types of particles, such as the display shown in Figures 1 to 3 of this application, displays only two different colors (the colors of the two types of particles, as shown in Figures 1 and 2) and various gray states between these two colors. The present display is capable of showing three separate colors (the colors of the two types of particles, as shown in Figures 1 and 2, and the color of the backing member, as shown in Figure 3) and various gray states among these three colors.

Claim 20 is in effect directed to a process for operating the display of claim 1 in which there is applied to the substrate an electric field effective to cause dielectrophoretic movement of the first (108) and second (110) types of particles to the side walls of the cavity, thus producing the state shown in Figure 3 or Figure 11.

Claim 35 is generally similar to claim 1 but requires only a single type of particle in the suspending fluid. This type of display allows for the display at each pixel of two colors (the color of the particles and the color of the backing member). Although prior art electrophoretic displays have permitted the display of two colors at each pixel, such displays have typically required either the use of a single type of particle in a dyed suspending fluid (with consequent problems relating to the stability, especially light stability, of the dye) or the presence of two types of particles in a clear suspending fluid, the two types of particles bearing electric charges of opposite polarity (with possible problems relating to the two types of particles sticking to each other in the long term). The display of claim 35 allows for the production of two colors at each pixel without either of these complications.

Finally, claim 47 is directed to a process for operating the dielectrophoretic display of claim 35.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 35, 36, 38, 39 and 43-47 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Batchelder, U.S. Patent No. 4,418,346, in view of Beni et al., (U.S. Patent No. 4,411,495. This rejection is stated as follows in the final Office Action:

As in claims 35 and 47, Batchelder teaches of a dielectrophoretic display, **column 2 lines 15-28 and 60-65, column 6 lines 45-50**, comprising:

a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface, **figure item 4 item 44, figure 7 item 88, column 6 lines 55-65**; said walls being defined by a gasket to produce a reservoir/cavity.

a suspending fluid contained within the cavity, **column 6 lines 55-65, figure 7 item 88**; heptane and octyl alcohol.

a plurality of at least one type of particle suspended within the suspending fluid, the particles having a first optical characteristic, **column 5 lines 42-63, figure 4 items 38 and 40**; said particles being a plurality of water bubbles provided in a said suspending fluid, said water bubbles containing Triton X 100 and Rhodamine (surfactant and fluorescent dye).

a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member, **column 6 lines 29-31**; said absorbing backing.

means for applying to the substrate an electric field effective to cause dielectrophoretic movement of the particles to the side wall of the cavity, **column 4 lines 9-40**. wherein as shown particles 38 and 40 move in opposite directions towards the wall/gasket portion not shown in figure 4.

Wherein the particle has one optical characteristic (fluorescent due to rhodamine) and the backing member also has an optical characteristic

(absorbing, reflecting, transmitting, or scattering), **column 2 lines 25-28, column 6 lines 14-43 and 60-65.**

However Batchelder fails to explicitly teach of said backing member having a second optical characteristic different from the first optical characteristic.

Beni et al. teaches of said absorbing backing member having a specific color, **figure 3 item 27, column 2 lines 55-65, column 3 lines 1-15**, in a display that advances the electrophoretic display technology by replacing the electrophoretic display medium with a liquid crystal display medium.

Wherein given that said backing members are known in the art to have a specific color in contrast to an image color formed by a display medium as taught by Beni, and Batchelder further teaches of having a distinguishable display particle of the fluorescent optical character and a light absorbing display backing, **it would have been obvious to the skilled artisan** at the time of the invention to provide for said absorbing backing member having a second optical characteristic different from the first optical characteristic for the purpose of contrasting an image for display as known in the art and suggested by both Batchelder and Beni, as found in claims 35 and 47.

As in claim **36**, Batchelder teaches of wherein the suspending fluid is substantially uncolored, and has suspended therein only a single type of particle, column 6 lines 58-64.

As in claim 38, Batchelder teaches of wherein the cavity has a non-circular cross-section as seen from the viewing surface, figure 7 item 88.

As in claim 39, Batchelder teaches of wherein the cavity forms a polygonal cross-section as seen from the viewing surface, figure 7 item 88.

As in claim 43, Becker et al. teaches of wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule, figure 7 item 88.

As in claim 44, Batchelder teaches of wherein comprising a plurality of capsules, the capsules being arranged in a single layer, column 5 lines 42-63.

As in claim 45, Batchelder teaches of wherein the substrate comprises a continuous phase surrounding a plurality of discrete droplets of the suspending fluid having the at least one type of particle suspended therein, column 6 lines 55-67, column 4 lines 1-5.

As in claim 46, Batchelder teaches of wherein the substrate comprises a substantially rigid material having the at least one cavity formed therein, the substrate further comprising at least one cover member closing the at least one cavity, **figure 4 and 7**.

2. Claims 37, 40-42, 48, and 49 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Batchelder in view of Beni et al. and further in view of Becker et al., U.S. Patent No. 3,960,439. This rejection is stated as follows in the final Office Action:

As in claims 37, 40-42, 48, and 49, Batchelder does not explicitly teach of said particle and drive features.

Becker et al. teaches of said well known drive features in a dielectrophoretic display as claimed, column 3 lines 59-66. Becker et al. teaches of all the elements of claims 35 and 47 and is only silent as to said backing member feature as claimed. **Therefore it would have been obvious** to the skilled artisan at the time of the invention to replace the dielectrophoretic medium of Batchelder in view of Beni et al. with the dielectrophoretic medium of Becker et al., because Becker et al. teaches of an alternative dielectrophoretic display known in the art, which would obviously serve as a design choice to a dielectrophoretic display means.

As in claims 37 and 49, Becker et al. teaches of wherein at least some of the at least one type of particle are electrically charged.

As in claim 40, Becker et al. teaches of wherein the at least one type of particle is formed from an electrically conductive material.

As in claim 41, Becker et al. teaches of wherein the at least one type of particle is formed from a metal or carbon black.

As in claim 42, Becker et al. teaches of wherein the at least one type of particle is formed from a doped semiconductor.

As in claim 48, Becker et al. teaches of wherein the electric field is an alternating electric field, column 11 lines 1-10.

3. Claims 1, 5-21, 24-35 and 47 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Bryning et al., U.S. Patent No. 5,582,700 in view of Ota, U.S. Patent No. 3,756,693. This rejection is stated as follows in the final Office Action:

As in claim 1, Bryning et al. teaches of a dielectrophoretic display comprising:
a substrate having walls defining at least one cavity, **figure 1 item 10**,
the cavity having a viewing surface and a side wall inclined to the viewing surface, **figure 1 item 14 and 17**;

a suspending fluid contained within the cavity, **figure 1 item 28**;

a plurality of a first type of particle suspended within the suspending fluid the first type of particle having a first optical character and a first electrophoretic mobility, **figure 1 item 24/26, column 6 lines 35-38, column 8 lines 38-65**; fluorescent 1, positively charged particle which moves adjacent and oppositely charged electrode.

a plurality of a second type of particle suspended within the suspending fluid, the second type of particle having a second optical characteristic different from the first optical characteristic, **figure 1 item 24/26, column 6 lines 35-38, column 8 lines 38-65**; fluorescent 2, negatively charged particle which moves adjacent and oppositely charged electrode.

a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a third optical characteristic different from the first and second optical characteristics, figure 7 item 50; and means for applying to the substrate an electric field effective to cause dielectrophoretic movement of the first and second types of particles to the side wall of the cavity, **column 14 lines 18-25 and 40-55.**

However Bryning does not explicitly teach of a second electrophoretic mobility different from the first electrophoretic mobility.

Wherein based on the application of an alternating voltage of a specific frequency the polar phase having two oppositely charged particles spreads in a direction to towards the walls 17, as known in the art, as taught by Ota. Further wherein based on the application of a direct voltage the particles move in opposite directions, as known in the art, as taught by Ota. Bryning teaches of mixtures of two or more dyes, of the type having positive and negative charges, wherein the mobility's are reflective of the opposite charge and movement through the suspending fluid to the adjacent electrode. Ota teaches that is well known for such a combination of differently colored oppositely charged electrophoretic particles to have different mobilities.

Therefore it would have been obvious to the skilled artisan at the time of the invention to provide for differently colored oppositely charged electrophoretic particles having different mobilities, because Ota teaches it is well known in electrophoretic display as taught by Bryning, as found in claims 1 and 20.

As in claim 20, Bryning et al. in view of Ota (as applied above to claim 1 for the added elements) teaches of a process for operating a dielectrophoretic display, the process comprising: providing a substrate having walls defining at least one cavity, **figure 1 item 10,**

the cavity having a viewing surface and a side wall inclined to the viewing surface, **figure 1 item 14 and 17;**

a suspending fluid contained within the cavity, **figure 1 item 28;**

and a plurality of at least one type of particle suspended within the suspending fluid, **figure 1 item 26;**

and applying to the substrate an electric field effective to cause dielectrophoretic movement of the particles to the side wall of the cavity, **column 14 lines 18-25 and 40-55.**

Wherein based on the application of an alternating voltage of a specific frequency the polar phase having two oppositely charged particles spreads in a direction to towards the walls 17, as known in the art, as taught by Ota. Further wherein based on the application of a direct voltage the particles move in opposite directions, as known in the art, as taught by Ota. Bryning teaches of mixtures of two or more dyes, of the type having positive and negative charges, wherein the mobility's are reflective of the opposite charge and movement through the suspending fluid to the adjacent electrode. Ota teaches that is well known for such a combination of differently colored oppositely charged electrophoretic particles to have different mobilities.

Therefore it would have been obvious to the skilled artisan at the time of the invention to provide for differently colored oppositely charged electrophoretic particles having different mobilities, because Ota teaches it is well known in electrophoretic display as taught by Bryning, as found in claims 20.

As in claim 11, Bryning et al. teaches of wherein the cavity has a non-circular cross-section as seen from the viewing surface, figure 1C item 18, figure 7.

As in claim 12, Bryning et al. teaches of wherein the cavity has a polygonal cross-section as seen from the viewing surface, column 11 lines 55-65.

As in claim 13 and 28, Bryning et al. teaches of wherein the at least one type of particle is formed from an electrically conductive material, column 8 lines 45-65.

As in claim 14, Bryning et al. teaches of wherein the at least one type of particle is formed from a metal or carbon black, column 8 lines 45-65.

As in claim 15 and 30, Bryning et al. teaches of wherein the at least one type of particle is formed from a doped semiconductor, column 8 lines 45-65.

As in claim 16, Bryning et al. teaches of wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule, figure 1 item 17.

As in claim 17 and 32, Bryning et al. teaches of comprising a plurality of capsules, the capsules being arranged in a single layer, figure 3 items 12.

As in claim 18 and 33, Bryning et al. teaches of wherein the substrate comprises a continuous phase surrounding a plurality of discrete droplets of the suspending fluid having the at least one type of particle suspended therein, figure 1C item 24.

As in claim 19 and 34, Bryning et al. teaches of wherein the substrate comprises a substantially rigid material having the at least one cavity formed therein, the substrate further comprising at least one cover member closing the at least one cavity, figure 1 items 14 and 16.

As in claim 21, Bryning et al. teaches of wherein the electric field is an alternating electric field, column 14 lines 50-55.

As in claim 29, Bryning et al. teaches of wherein the at least one type of particle is formed from a metal or carbon black, column 8 lines 45-65.

As in claim 31, Bryning et al. teaches of wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule, figure 3 item 12.

As in claims 35 and 47, Bryning et al. teaches of a dielectrophoretic display, figure 1 item 10, column 14 lines 18-25 and 40-56, comprising:

a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface, **figure 1 item 17 and 14;** said walls 17 and said viewing surface 14 or figure 7 item 14.

a suspending fluid contained within the cavity, **figure 1 item 28;** non-polar phase

a plurality of at least one type of particle suspended within the suspending fluid, the particles having a first optical characteristic, **figure 1 item 24/26;** said particles being a represented by the dye 26 dissolved in the polar phase 24, where the dye can be fluorescent.

a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a second optical characteristic different from the first optical characteristic, **figure 7 item 50.** wherein the backing member is reflective.

means for applying to the substrate an electric field effective to cause dielectrophoretic movement of the particles to the side wall of the cavity, **column 7 lines 40-60, column 14 lines 18-25 and 40-55.**

Wherein the particle has one optical characteristic (dyes 26, column 8 lines 45-56, fluorescent) and the backing member also has an optical characteristic (reflecting mode, nontransparent, reflective), column 7 lines 30-40, column 10 lines 43-46, column 11 lines 33-40.

As in claim 5 and 24, Ota teaches of wherein the first and second electrophoretic mobilities differ in sign, so that the first and second types of particles move in opposed directions in an electric field, column 7 lines 50-65.

As in claim 6, Bryning et al. teaches of wherein the suspending fluid is substantially uncolored, figure 1 item L2, figure 13 item L5.

As in claim 10, Ota teaches of wherein the first and second optical characteristics comprise black and white colors, figure 1 item 6, column 2 lines 60-67, column 7 lines 55-65.

As in claim 7 and 26, Ota teaches of further comprising a backing member disposed on the opposed side of the cavity from the viewing surface, figure 4 item 5, at least part of the backing member having a third optical characteristic different from the first and second optical characteristics, figure 4 items 19 and 20, column 7 lines 55-65. Wherein said particles are black and white, and said substrate is opaque or transparent.

As in claim 25, Ota teaches of further comprising: applying an electric field of a first polarity to the cavity, thereby causing the first type of particles to approach the viewing surface and the cavity to display the first optical characteristic at the viewing surface, figure 4 item 19, column 5 lines 3-1 6, column 7 lines 55-63;

and applying an electric field of a polarity opposite to the first polarity to the cavity, thereby causing the second type of particles to approach the viewing surface and the cavity to display the second optical characteristic at the viewing surface, figure 4 item 20, column 5 lines 3-16, column 7 lines 55-63.

As in claim 8, 9, and 27, Bryning et al. is silent as to wherein the backing member comprises areas having third and fourth optical characteristics different from each other and from the first and second optical characteristics. However said variations represent known design choices to providing color displays as known in the art. Ota teaches of varying the color scheme, column 3 lines 10-50, column 7 lines 55-65, wherein said claims limitations would have been an obvious design choice in view of Ota, as found in claims 8, 9, and 27.

ARGUMENT

[Since the rejections set out above are primarily applied separately to two discrete groups of claims, claims 1, 5, 6, 8-21, 24, 24 and 27-34 on the one hand and claims 35-49 on the other, the argument below will treat these groups of claims in numerical order rather than following the order of the rejections in the final Office Action.]

Summary

Claims 1, 5, 6, 8-21, 24, 24 and 27-34 are patentable because (a) Bryning does not describe any medium having two separate types of particles; and (b) neither Bryning nor Ota describes a display which effects dielectrophoretic movement of particles to a sidewall of a cavity.

Claims 35-49 are patentable because none of the references teach a display in which a plurality of particles are moved to the side wall of a cavity, as required by these claims/

Detailed argument

Summary of prior art

Bryning describes an electrophoretic display utilizing phase separation of liquids. The display includes spaced first and second electrodes, and an emulsion positioned between the electrodes. (See the Abstract.) The emulsion includes a continuous non-polar phase and a discontinuous polar phase. The polar phase is capable of forming droplets in the non-polar phase. The polar phase includes a dye which is insoluble in the non-polar phase, a polar solvent, and a detergent. An image is formed on the display by applying an electric field across the emulsion which causes the polar phase droplets to redistribute themselves relative to the non-polar phase, redistribution including the coagulation of the polar phase in the non-polar phase as well as the separation of the polar phase from the non-polar phase. The operation of the display is illustrated in Figures 10 and 11 and the accompanying description in columns 12 and 13.

Ota describes an electrophoretic display which can have two different types of particles with differing electrophoretic mobilities and optical properties (see Figures 3 and 4 and column 4, lines 54-63).

Batchelder describes a dielectrophoretic display for selectively displaying visual information using dielectrophoretic forces. Figure 5, for example, illustrates a display in which a bubble 80 of one material is translated over a series of electrodes 76, 78, the position of the bubble conveying visual information.

Beni describes a refractive index switchable display cell having a first material with a first index of refraction, a second material dispersed within the first material and having a second index of refraction, the difference between the first and second indices being variable, typically by means of an electric field applied across the materials. When the two indices of refraction are substantially the same, the display is substantially transparent; otherwise, the display is opaque or at least less transparent (see the Abstract). Thus the display acts as a light gate.

Becker describes a system for transforming an optically negative liquid crystalline composition from the focal-conic texture state to the Grandjean texture state by means of an applied electrical field which may be a DC or AC field.

Patentability of claims 1, 5, 6, 8-21, 24, 24 and 27-34

(a) Bryning does not describe a display having two separate types of particles

Bryning describes an electrophoretic display having (the applicants concede) a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface, and a suspending fluid contained within the cavity. However, the Bryning display does not comprise two separate types of particles; the display is of an unusual "liquid in liquid" type, having a discontinuous polar phase comprising a polar solvent, a dye and a detergent. Even assuming, *arguendo*, that the discrete droplets of the polar phase in Bryning can be regarded as "particles" as that term is used in the present claims, there is no disclosure in Bryning of any display having two separate types of such particles. In

support of its contention that Bryning does describe two separate types of particles, the final Office Action refers to (i) Figure 1, item 24/26; (ii) Column 6, lines 35-38; and (iii) column 8, lines 38-65. With regard to (i), the Bryning specification states that "the polar phase 24 solubilizing the dye 26 forms an emulsion in the non-polar phase 28" (column 7, lines 6-7), there being no hint of any "double" emulsion. Passage (ii) on its face contains no indication of two types of particles. Passage (iii) mentions the possibility of using mixtures of two or more dyes, but using multiple dyes does not imply multiple different types of droplets; obviously mixtures of dyes can be used within a single type of droplet of polar phase 24, and nothing in Bryning suggests that this is not the intended meaning of Passage (iii).

Furthermore, the mode of operation of the Bryning display strongly suggests that it cannot contain more than a single type of droplet. As shown in Figure 10 and as described beginning at column 12, lines 31, when no electric field is applied to the display, an emulsion of a discontinuous polar phase in a continuous non-polar phase forms spontaneously (column 12, lines 38-39 and Figure 10A). This is the "off" state of the display (Figure 10A). To turn the display "on", a DC electric field may be applied to cause the polar droplets to accumulate adjacent divided electrodes 56, thus causing the pixels to assume the optical characteristics of the non-polar phase (column 12, lines 50-54, and Figure 10B) or an AC field may be applied to cause the droplets to "coagulate" into larger droplets spaced from the electrodes 56, with essentially the same optical result (column 12, lines 54-59 and Figure 10C). To erase the display (i.e., to return it to an "off" state), either a DC field is applied which causes the polar phase to coagulate adjacent the undivided electrodes 58A, 58B (column 12, lines 63-66 and Figure 10D) or an AC field is applied causing the polar phase to re-disperse throughout the non-polar phase (column 12, line 66 to column 13, line 5 and Figure 10E).

From the foregoing, it will be seen that operation of the Bryning display requires coagulation and redispersion of the droplets of the polar phase. If one attempted to produce a "two-particle" version of the Bryning display with two different set of droplets, it is difficult to

see how one could avoid mixing of the two types of droplets during this coagulation and re-dispersal process.

(b) Neither Bryning nor Ota describes a display which effects dielectrophoretic movement of particles to a side wall of a cavity

It will be seen from the preceding paragraphs that the operation of the Bryning display does not rely upon movement of droplets to a side wall of a cavity, and neither the drawings nor the description of Bryning show such dielectrophoretic movement to a side wall. The final Office Action alleges that column 14, lines 18-25 and lines 40-55 disclose this feature of the present claims. With respect, lines 18-25 refer only to coagulation and spreading of the polar phase. Such coagulation and spreading must refer to, for example the coagulation of droplets in Figures 10B and 10C and the spreading of the coagulated polar phase over electrodes, as shown in Figure 10D. There is nothing in this passage to suggest movement to a side wall of a cavity. Similarly, lines 40-55 refer only to erasing as shown in the drawings of movement of the polar phase in the X and Y directions on surfaces of the electrodes, for example as shown in Figure 10D. Again, there is nothing in this passage to suggest movement to a side wall of a cavity.

The final Office Action does not suggest that Ota discloses dielectrophoretic movement to a sidewall of a cavity and applicants simply note that Ota only describes and illustrates movement of particles directly between two opposed electrodes.

Applicants would stress that the aforementioned differences between present claims 1, 5, 6, 8-21, 24, 24 and 27-34 on the one hand and Bryning and Ota on the other are not merely matters of design choice. The present display is designed to provide three different extreme optical states, as illustrated Figures 1-3 or 9-11 (and see claim 25). The Bryning and Ota displays each provide only two extreme optical states. The Bryning display provides one state (Figure 10D or 10E) where each pixel displays the color of the polar phase and a second state (Figure 10B or 10C) which is substantially transparent. The double particle embodiment in Ota provides two different colored states corresponding to colors of the two types of particles. At the risk of oversimplifying, one might say that Ota provides states corresponding

to present Figures 1 and 2, Bryning provides states analogous to present Figures 1 and 3, but neither display can provide all the states of present Figures 1-3.

Patentability of claims 35-49

None of the references teaches a display in which a plurality of particles are moved to the side wall of a cavity

As noted above, Batchelder describes a dielectrophoretic display for selectively displaying visual information using dielectrophoretic forces. Figure 5, for example, illustrates a display in which a bubble 80 of one material is translated over a series of electrodes 76, 78, the position of the bubble conveying visual information.

The final Office Action states that column 4, lines 9-40 describes a display in which there is applied to a substrate an electric field effective to cause dielectrophoretic movement of particles to the side wall of a cavity. With respect, this passage, which is describing Figure 4 of Batchelder does not describe movement to a side wall, but merely lateral movement parallel to the plane of the electrodes 54, 56, 58 and 60. Present claims 35-49 require movement to the side wall, not merely in the general direction of this side wall. The Batchelder display is intended to selectively display visual information by positioning a "bubble", such as item 80 in Figure 5, at one of a plurality of predetermined locations, as provided by the "ladders" of electrodes 74 etc. It is entirely unclear why, in such a display, one would wish to move a single bubble, let alone a plurality of such bubbles, to a side wall, and the ladder structure shown in Figure 5 would appear incapable of propelling the bubbles adjacent a side wall, since the bubble apparently occupies positions between adjacent pairs of electrodes (cf. Figure 2). Moving the bubbles adjacent the side wall would apparently not convey any visually useful information.

Bryning and Ota have already discussed above. In Beni, because only the refractive index of one material is being changed, there is no macroscopic translation of particles at all, so there can be no dielectrophoretic movement of particles to a side wall. Becker is solely concerned with a liquid crystal medium in which there are no particles, and hence, *a fortiori*, no dielectrophoretic movement of particles to a side wall.

Again, applicants would stress that the aforementioned differences between present claims 35-49 and Batchelder is not merely a matter of design choice. The display of claims 35-49 is designed to provide two different extreme optical states, as illustrated in (say) Figures 1 and 3, in one of which (Figure 1) the viewing surface of the pixel is covered by the particles, so that the pixel has the optical characteristics of the particles, while in the other state the particles are moved aside so that the pixel displays the optical characteristics of the substrate. The Batchelder display has no state corresponding to present Figure 1; instead, it is essentially permanently in a state corresponding to present Figure 3 and the only changes are caused by movement of the bubble against a background provided by the substrate.

For all of the foregoing reasons, the rejections of the claims on appeal should be reversed and the application allowed.

Respectfully submitted
/David J. Cole/
David J. Cole
Registration No. 29629

E INK Corporation
733 Concord Avenue
Cambridge MA 02138

Telephone (617) 499-6069
Facsimile (617) 499-6200
E-mail dcole@eink.com

CLAIMS APPENDIX

Claims on Appeal

1. A dielectrophoretic display comprising:
 - a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface;
 - a suspending fluid contained within the cavity;
 - a plurality of a first type of particle suspended within the suspending fluid, the first type of particle having a first optical characteristic and a first electrophoretic mobility;
 - a plurality of a second type of particle suspended within the suspending fluid, the second type of particle having a second optical characteristic different from the first optical characteristic and a second electrophoretic mobility different from the first electrophoretic mobility;
 - a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a third optical characteristic different from the first and second optical characteristics; and
 - means for applying to the substrate an electric field effective to cause dielectrophoretic movement of the first and second types of particles to the side wall of the cavity.
5. A dielectrophoretic display according to claim 1 wherein the first and second electrophoretic mobilities differ in sign, so that the first and second types of particles move in opposed directions in an electric field.
6. A dielectrophoretic display according to claim 1 wherein the suspending fluid is substantially uncolored.
8. A dielectrophoretic display according to claim 1 wherein the backing member comprises areas having third and fourth optical characteristics different from each other and from the first and second optical characteristics.
9. A dielectrophoretic display according to claim 1 wherein the backing member comprises areas having red, green and blue or yellow, cyan and magenta colors.

10. A dielectrophoretic display according to claim 1 wherein first and second optical characteristics comprise black and white colors.

11. A dielectrophoretic display according to claim 1 wherein the cavity has a non-circular cross-section as seen from the viewing surface.

12. A dielectrophoretic display according to claim 11 wherein the cavity has a polygonal cross-section as seen from the viewing surface.

13. A dielectrophoretic display according to claim 1 wherein at least one of the first and second types of particles is formed from an electrically conductive material.

14. A dielectrophoretic display according to claim 13 wherein the electrically conductive material is a metal or carbon black.

15. A dielectrophoretic display according to claim 1 wherein at least one of the first and second types of particles is formed from a doped semiconductor.

16. A dielectrophoretic display according to claim 1 wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule.

17. A dielectrophoretic display according to claim 16 comprising a plurality of capsules, the capsules being arranged in a single layer.

18. A dielectrophoretic display according to claim 1 wherein the substrate comprises a continuous phase surrounding a plurality of discrete droplets of the suspending fluid having the first and second types of particles suspended therein.

19. A dielectrophoretic display according to claim 1 wherein the substrate comprises a substantially rigid material having the at least one cavity formed therein, the substrate further comprising at least one cover member closing the at least one cavity.

20. A process for operating a dielectrophoretic display, the process comprising:

providing a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface; a suspending fluid contained

within the cavity; a plurality of a first type of particle suspended within the suspending fluid, the first type of particle having a first optical characteristic and a first electrophoretic mobility; a plurality of a second type of particle suspended within the suspending fluid, the second type of particle having a second optical characteristic different from the first optical characteristic and a second electrophoretic mobility different from the first electrophoretic mobility; and a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a third optical characteristic different from the first and second optical characteristics; and

applying to the substrate an electric field effective to cause dielectrophoretic movement of the first and second types of particles to the side wall of the cavity.

21. A process according to claim 20 wherein the electric field is an alternating electric field.

24. A process according to claim 20 wherein the first and second electrophoretic mobilities differ in sign, so that the first and second types of particles move in opposed directions in an electric field.

25. A process according to claim 24 further comprising:

applying an electric field of a first polarity to the cavity, thereby causing the first type of particles to approach the viewing surface and the cavity to display the first optical characteristic at the viewing surface; and

applying an electric field of a polarity opposite to the first polarity to the cavity, thereby causing the second type of particles to approach the viewing surface and the cavity to display the second optical characteristic at the viewing surface.

27. A process according to claim 20 wherein the backing member comprises areas having third and fourth optical characteristics different from each other and from the first and second optical characteristics.

28. A process according to claim 20 wherein at least one of the first and second types of particles is formed from an electrically conductive material.

29. A process according to claim 28 wherein the electrically conductive material is a metal or carbon black.

30. A process according to claim 28 wherein at least one of the first and second types of particles is formed from a doped semiconductor.

31. A process according to claim 20 wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule.

32. A process according to claim 20 wherein the substrate comprises a plurality of capsules, the capsules being arranged in a single layer.

33. A process according to claim 20 wherein the substrate comprises a continuous phase surrounding a plurality of discrete droplets of the suspending fluid having the first and second types of particles suspended therein.

34. A process according to claim 20 wherein the substrate comprises a substantially rigid material having the at least one cavity formed therein, the substrate further comprising at least one cover member closing the at least one cavity.

35. A dielectrophoretic display comprising:

- a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface;
- a suspending fluid contained within the cavity;
- a plurality of at least one type of particle suspended within the suspending fluid, the particles having a first optical characteristic;
- a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a second optical characteristic different from the first optical characteristics; and

means for applying to the substrate an electric field effective to cause dielectrophoretic movement of the particles to the side wall of the cavity.

36. A dielectrophoretic display according to claim 35 wherein the suspending fluid is substantially uncolored, and has suspended therein only a single type of particle.

37. A dielectrophoretic display according to claim 35 wherein at least some of the at least one type of particle are electrically charged.

38. A dielectrophoretic display according to claim 35 wherein the cavity has a non-circular cross-section as seen from the viewing surface.

39. A dielectrophoretic display according to claim 38 wherein the cavity has a polygonal cross-section as seen from the viewing surface.

40. A dielectrophoretic display according to claim 35 wherein the at least one type of particle is formed from an electrically conductive material.

41. A dielectrophoretic display according to claim 40 wherein the at least one type of particle is formed from a metal or carbon black.

42. A dielectrophoretic display according to claim 35 wherein the at least one type of particle is formed from a doped semiconductor.

43. A dielectrophoretic display according to claim 35 wherein the substrate comprises at least one capsule wall so that the dielectrophoretic display comprises at least one capsule.

44. A dielectrophoretic display according to claim 43 comprising a plurality of capsules, the capsules being arranged in a single layer.

45. A dielectrophoretic display according to claim 35 wherein the substrate comprises a continuous phase surrounding a plurality of discrete droplets of the suspending fluid having the at least one type of particle suspended therein.

46. A dielectrophoretic display according to claim 35 wherein the substrate comprises a substantially rigid material having the at least one cavity formed therein, the substrate further comprising at least one cover member closing the at least one cavity.

47. A process for operating a dielectrophoretic display, the process comprising:

providing a substrate having walls defining at least one cavity, the cavity having a viewing surface and a side wall inclined to the viewing surface, a suspending fluid contained within the cavity; and a plurality of at least one type of particle suspended within the suspending fluid, the particles having a first optical characteristic; and a backing member disposed on the opposed side of the cavity from the viewing surface, at least part of the backing member having a second optical characteristic different from the first optical characteristic; and

applying to the substrate an electric field effective to cause dielectrophoretic movement of the particles to the side wall of the cavity.

48. A process according to claim 47 wherein the electric field is an alternating electric field.

49. A process according to claim 47 wherein at least some of the at least one type of particle are electrically charged.

EVIDENCE APPENDIX

[None]

RELATED PROCEEDINGS APPENDIX

[None]